

REMARKS

Claims 1, 46-48 and 52 have been amended. Claim 1, 6-13, 16, 17 and 46-52 remain pending in the present application. Applicants reserve the right to pursue the original and any other claims in this and other applications.

Claim 52 stands rejected under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 52 has been amended to address the concerns of the Office Action. Thus, Applicants respectfully request that the rejection be withdrawn and claim 52 allowed.

Claims 1, 6-8, 10-17 and 49 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kelly (U.S. Patent No. 5,071,670) in view of Fong (U.S. Patent No. 5,935,334). The rejection is respectfully traversed.

Claim 1 recites an atomic layer doping apparatus comprising "a first atomic layer doping region" and "a second atomic layer doping region, different from said first atomic doping region," where the two atomic layer doping regions are "chemically isolated from one another by a vertical inert gas curtain."

Kelly, on the other hand, relates to a sequential CVD apparatus in a single reactor vessel 12. In particular, the reaction-containing pressure vessel 12 of Kelly consists of "[t]wo gas sources 14 and 16 [that] are contained within the interior of the vessel 12 and [which] direct their respectively different gases upwardly through gas emission plates 18 and 20." (Column 4, lines 13-16). In other words, the substrate in Kelly will be subjected to two distinct gaseous environments within the same doping region and without any physical barriers between the two environments. (See column 4, lines 32-35). This is contrary to the claimed invention where an inert gas curtain is

provided between the two atomic layer doping regions to prevent the cross contamination of the first and second gas species. The claimed invention comprises two atomic layer doping regions whereas Kelly discloses only one. Thus, the Kelly structure and the claimed invention are completely different from each other.

As such, Kelly does not teach an atomic layer doping apparatus comprising two different atomic layer doping regions, much less “a first atomic layer doping region” and “a second atomic layer doping region, different from said first atomic doping region,” that are “chemically isolated from one another by a vertical inert gas curtain,” as recited in claim 1.

Moreover, Kelly teaches that there are no physical barriers that separate the two environments e1 and e2 (FIG. 1; *see also* column 4, lines 28-35). Hence, Kelly cannot disclose an atomic layer doping apparatus having “a vertical inert gas curtain” that chemically isolates the two atomic layer doping regions from each other. In the claimed invention, the structure comprises a physical barrier, i.e., a vertical inert gas curtain, that separates the first atomic layer doping region from the second atomic doping region.

In an effort to satisfy the shortcomings of Kelly, the Office Action combines Fong with Kelly. Fong is cited by the Office Action as teaching a first atomic layer region used for deposition and a second atomic layer region used for thermal diffusion of the dopant species. (Office Action at 3). However, even assuming the Office Action’s statement regarding Fong to be true, which Applicants do not concede, Fong does not teach or suggest an atomic layer doping apparatus comprising “a first atomic layer doping region” and “a second atomic layer doping region, different from said first atomic doping region,” where the two atomic layer doping regions are “chemically isolated from one another by a vertical inert gas curtain.” Therefore, Fong does not

satisfy or cure the shortcomings of Kelly. Neither reference teaches or suggests such limitations.

For at least the reasons set forth above, Kelly and Fong do not, and cannot teach or suggest all limitations of claim 1. Nor would it have been obvious to one of ordinary skill in the art to combine the cited references to achieve the claimed invention. Claims 6-8, 10-17 and 49 depend from claim 1 and should be allowable along with claim 1. Accordingly, Applicants respectfully request that the rejection be withdrawn and the claims allowed.

Claim 9 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Kelly, Fong, and Henley (U.S. Patent No. 6,207,005). Claims 46 and 50 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kelly in view of Fong and Gattuso (European Patent Application No. 060626). Claims 47 and 51 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kelly in view of Fong and Hartig (U.S. Patent No. 5,382,126). The rejections are respectfully traversed.

Claim 9 depends from claim 1 and thus recites the limitations described above. Claims 46 and 47 recite similar limitations as described above in relation to claim 1. For at least the reasons set forth above, Kelly and Fong fail to teach or suggest an atomic layer doping apparatus comprising a first atomic layer doping region and a second atomic layer doping region that are different from the first atomic doping region, where the two atomic layer doping regions are chemically isolated from one another by a vertical inert gas curtain.

The Office Action combines Henley, Gattuso and Hartig to cure the shortcomings of Kelly and Fong for certain claim limitations. However, Henley, Gattuso and Hartig have the same shortcomings as the other cited references. Henley is

cited as teaching an apparatus comprising a third pair of atomic layer doping regions. (Office Action at 3). Gattuso is cited as teaching an inert gas curtain provided at a higher pressure than the first dopant species. (Office Action at 4). Hartig is cited as teaching a separate gas exhaust for each region in a multi-chamber coating apparatus. However, Henley, Gattuso and Hartig do not teach or suggest an atomic layer doping apparatus comprising “a first atomic layer doping region” and “a second atomic layer doping region, different from said first atomic doping region,” where the two atomic layer doping regions are “chemically isolated from one another by a vertical inert gas curtain,” as recited in the claims. Thus, the additionally cited references do not cure the deficiencies of the Kelly and Fong combination.

Hence, the cited combinations do not teach or suggest all limitations of the claimed inventions. Nor would it have been obvious to one of ordinary skill in the art to combine the cited references to achieve the claimed invention. Therefore, claims 9, 46 and 47 should be allowable. Claim 50 depends from claim 46 and is allowable along with claim 46. Claim 51 depends from claim 47 and is allowable along with claim 47. Accordingly, Applicants respectfully request that the rejections be withdrawn and the claims allowed.

Claim 48 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Maeda (U.S. Patent No. 5,314,538) in view of Fong.

Claim 48 recites an atomic layer doping apparatus comprising “a first atomic layer doping region . . . for depositing a first dopant species on a first substrate as an atomic monolayer with a first reaction process in the first atomic layer doping region; a second atomic layer doping region . . . for diffusing said first dopant species in said first substrate with a second reaction process.” Claim 48 further recites that the “first and second atomic layer doping regions are different and isolated from one another by a

vertical physical barrier having a closeable opening, and wherein said second reaction process is different from said first reaction process.”

Maeda relates to a multi-processing apparatus; however, Maeda’s apparatus consists of three separate components. In particular, Maeda refers to an apparatus having a CVD reaction chamber for forming a film on a wafer and a heat-processing chamber. Contrary to the claimed invention, Maeda’s apparatus cannot have two atomic layer doping regions, one for depositing one gas species on a substrate and a second for depositing a second gas species on the first gas species. In fact, Maeda teaches the opposite. Maeda’s apparatus is only capable of having one deposition region, and a processing region (*i.e.*, heat-treatment region).

As such, Maeda does not disclose or suggest “a first atomic layer doping region for depositing a first dopant gas species . . . , [and] a second atomic layer doping region, different from said first atomic layer doping region, for diffusing said first dopant gas species in said first substrate with a non-reactive gas species with a second reaction process, wherein [the] first and second atomic layer doping regions are different and isolated from one another by a vertical physical barrier having a closeable opening,” as recited in claim 48. Maeda’s apparatus does not, and cannot have two atomic layer doping regions, much less disclose an apparatus having a first atomic layer doping region and a second atomic layer doping region that “are different and isolated from one another by a vertical physical barrier having a closeable opening.”

The Office Action seeks to overcome the deficiencies of Maeda by combining it with Fong. Fong is cited for teaching a first atomic layer region used for deposition and a second atomic layer region used for thermal diffusion of the dopant species. (Office Action at 7). However, even assuming the Office Action’s statement regarding Fong to be true, which Applicants do not concede, Fong adds nothing to rectify the

deficiencies of Maeda. Fong does not disclose or suggest an apparatus having a first atomic layer doping region and a second atomic layer doping region that "are different and isolated from one another by a vertical physical barrier having a closeable opening."

Therefore, Maeda and Fong, whether considered alone or in combination, fail to teach or suggest all limitations of claim 48. Moreover, it would not have been obvious to one of ordinary skill in the art to combine the cited references to achieve the claimed invention. Accordingly, Applicants respectfully request that the rejection be withdrawn and the claim allowed.

In view of the above amendment, Applicants believe the pending application is in condition for allowance.

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